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THE RADIO CORPORATION OF AMERICA

THE DEDICATION OF THE LABORATORIES AT PRINCETON, N. J.

THE new RCA Laboratories built by the Radio Corporation of America at Princeton, New Jersey, a modern center of radio and electronic research, were dedicated on September 27.

Lieutenant General James G. Harbord, chairman of the board of Radio Corporation of America, presided and introduced the speakers: Major General Dawson Olmstead, chief signal officer of the Army; Colonel David Sarnoff, U. S. Army Signal Corps, and Otto S. Schairer, vice-president in charge of RCA Laboratories.

General Harbord pointed out that the RCA Laboratories assemble under one roof kindred activities which have hitherto been performed by individuals widely separated by time and space. "The Laboratories give our future scientific work the advantage of collective effort—the advantage in our attack on our problems of delivering a blow with a clenched fist instead of with open fingers. They promise much for the future of the radio industry, now so closely tied in with our war effort. And when the lights are once more turned on in this darkened world, we shall take off from here for a brilliant future of which we can now dream but can not measure."

Ground was broken for the laboratories on August 8, 1941. On November 15 of that year the cornerstone was laid, dedicating the project to increase in the usefulness of radio and electronics to the nation.

A tour of the laboratories reveals their size, magnificence, efficiency and promise. It is not only a radio laboratory, but many laboratories which reveal that modern radio is a science spreading into many fields—electronics, sound-acoustics, chemistry, physics,

mechanics and optics, from which grow many by-products and branches—cathode ray tubes, fluorescent materials, lenses and photography.

The laboratories building is a three-story structure with long corridors into which open 150 laboratory bays. To understand what is behind them, the inspection must begin in the basement. It is the nerve center. Into it, through underground arteries of conduits and pipes, are fed the electric power, gas and water supply. Alongside huge water tanks and air-conditioning apparatus are transformers and vault-enclosed power regulators, while the compressed air and steam are supplied from the heating plant. From two 300-foot wells, 600 gallons of water are pumped in a minute.

All the services of electricity, water and gas flow in conduits on the basement ceiling under the main corridor. There are 104 vertical shafts, which rise from basement to penthouse, with outlets on each floor. From these, wires and pipes carry the vital services to 420 work-benches, each 6 feet long. These unique service shafts are described as a most important feature and development—an original contribution to laboratory construction.

Standing at the point where the "T" of the laboratories structure is crossed, on each of the three floors one looks to the right and left down the 244-foot corridors or wings. The total length of a corridor from end to end is 488 feet. That is the span across the top of the "T." The doors on both sides of these spacious hallways on all three decks open to the many laboratory bays, and to nine administrative research offices and workshops. On the main floor, the general office section is near the entrance. Executive offices are in a section on the third floor.

Entering one of the laboratory bays, visitors are impressed with the spaciousness and broad daylight exposure, supplemented by modern indirect lighting, which casts no shadows. The work-benches are so designed and arranged as to be a joy to any worker. A wiring trough extends along the top of each bench, and the markings on the panel outlets indicate that almost any phase of electric current—AC or DC, and at various voltages, is at the finger-tips of the experimenter. In addition, there are taps on the bench for air, gas and water, as well as hydrogen and oxygen in the bays where they are used. And, of course, there are convenient electric plugs for soldering irons and other electrically operated tools. Flexibility in construction is the keynote.

The many laboratory bays indicate a great variety of activity within the laboratories. The Television Laboratory is described as "the last word in facilities for television research." Other laboratory bays are devoted to research in chemistry, especially fluorescent materials; acoustics, radio facsimile, centimeter-wave transmission and reception, receiving tubes, cathode ray tubes, transmitter tubes, under-water sound and various activities associated with the future of radio and electronics.

The model shop is considered to be the most modern of its kind and the best equipped in the world. For example, the meter room has complete calibrating equipment and 3,000 different meters available for covering voltage, current, temperature and speed. The Technical Library of the laboratories is catalogued as "complete in the communication field." There is an ultra-modern kitchen which adjoins a cafeteria with a capacity to serve from 180 to 200 persons at a time.

SCIENTIFIC RESEARCH IN WAR AND PEACE

THANK you, General Harbord and Mr. Schairer, for inviting me to attend the dedication of the RCA Laboratories. It's comforting to know that one is not forgotten by his own family, even when he is as far away from home as Washington. It is a real privilege to be here to-day and see in being the dreams of years.

When the cornerstone of this building was laid in November of last year, I attended the ceremonies by radio on board a ship on the Pacific Ocean somewhere between Honolulu and San Francisco. At that time we were blissfully unaware of what was immediately ahead of us. At the very hour the cornerstone was put in place, the plans of the Japanese war staff to attack Pearl Harbor must have been completed. The enemy ships and planes, which three weeks later were to plunge this nation into war, were in readiness to set forth on their treacherous mission. Our days of peace were numbered, and their number was very few.

It is significant that the foundations of this building were laid in time of peace, and its superstructure has been raised in time of war. Similarly, the modern sciences of radio and electronics have their roots in peaceful soil—in the search by men of good will for ways and means to make the world a better place to live in. Yet these sciences, and all science, are now enlisted in total war.

Total war as it is fought to-day is more than a war of populations or mere quantity of weapons or alone the human qualities of courage and endurance. More than ever before in history, this war is a contest between the brains and imagination and teamwork of the scientists, engineers and production workers of one group of nations, pitted against those of another group. While it is true that the decision ultimately will be made on the battlefield, the high seas and in the air, the fighting men who have the greatest resources of science, engineering and production back of them will be the victors.

Most people are aware that science is making a tremendous contribution to modern war in terms of guns, high explosives, airplanes, radio and synthetic rubber. By developing and improving these vitally important

products, a comparatively small number of scientists may be a far more powerful fighting force than an enemy army of millions of men.

But scarcely less important are scientific developments in many fields of chemistry, medicine and agriculture. Plastics, synthetic textiles, dehydrated foods, high-octane gasoline, aluminum, magnesium and scores of other materials and products important to the war effort are being produced on a vast scale, thanks in large measure to American industrial research.

Developments like these are the result of organized scientific effort, in laboratories such as the one you dedicate here to-day. But organized research is a peace-time product, the result of the slow and careful assemblage of men and facilities long before the urgency of war makes its call for the utmost efforts of a nation.

The United States has been fortunate in the vision of its private enterprises and universities which, long prior to the war, assembled such staffs and built such facilities. True, they did not build them to serve as adjuncts to military forces, as did our enemies. America's purpose was not the conquest of other nations, but conquests over the forces of nature, over ignorance, over poverty, over disease.

Our country is fortunate too that the officers and men in its military and naval establishments, on land, at sea and in the air, have a progressive attitude towards scientific research. They realize its possibilities, not only as a factor in war, but also in peace.

Indeed, the scientists in the laboratories of the Army and Navy and other government departments themselves have made scientific contributions from which our country has benefited in the past and will continue to benefit in the future.

And now, these fine minds and these superb facilities developed to serve peaceful ends are being brought to bear upon the gravest problem which they have ever faced—the problem of survival against ruthless aggression backed by prolonged military preparation.

Only a portion of America's scientific manpower has been fully used thus far in the war effort. The results, however, are already apparent, both in new and improved equipment of our fighting forces, and in the ingenuity displayed by industrial laboratories in developing ways of overcoming problems such as the shortages of critical materials. I have no doubt as to the ultimate result when all our available forces of science are organized and applied to the single purpose of achieving victory.

Of all the fertile fields which American men of science have cultivated for peace and now harvest for war, radio is in the first rank of importance. Speed of communication—on land, at sea and in the air—is the essence of modern warfare.

Aviation, which has so radically revolutionized military and naval strategy, is particularly dependent upon the countless services of radio. We could not have efficient aviation without radio any more than we could have city skyscrapers without elevators.

Admiral Dewey, hero of Manila Bay, would not recognize the radio control room of a modern battleship, where dozens of transmitters and receivers maintain constant communication with other ships, with stations on shore and with planes overhead.

And on land, tanks, armored cars and infantry units carry specially designed radio equipment which enables them to move and to strike with maximum power and precision.

It is particularly fortunate that during the period prior to America's entry into the war the Radio Corporation of America built up its research organization, and that RCA scientists and engineers gained experience along lines that are now of vital military importance.

In the last analysis, a research laboratory consists not so much of buildings and facilities as it does of research men and research leadership. The staff of these laboratories is as fine a group of radio scientists as exists anywhere in the world. They have produced outstanding developments in new electronic devices, in television, in ultra-short waves, in acoustics and in many other branches of radio research. The skills which they developed before the war are now finding direct use in important military applications.

The Spanish writer, Madariaga, once remarked that statesmen were of two kinds—paper men and gold men. The paper men, he said, had value only in a certain place at a certain time. The gold men were good anywhere, anytime.

There are paper men and gold men in every walk of life, but if we were asked among what group we had met the highest percentage of gold men, I think many of us would say it was among the men of science. The explanation may be that they dedicate their lives to an endless search for the pure gold of scientific truth, and are never satisfied with any baser metal.

Consequently, our admiration for these laboratories is based upon more than their obviously fine qualities of architecture and construction. We are moved by the deep respect in which we hold the virtues of scientific accuracy and intellectual integrity. These are virtues possessed to a high degree by the type of men who will work within these walls. These are the qualities which are helping to preserve our civilization, and which in turn make our civilization worth fighting for.

We congratulate you, Mr. Schairer, and your associates upon the completion of this home of RCA Laboratories. You are dedicating it to-day to the cause of victory for the United Nations. Until that victory is achieved, this building and the men who

work here can aim toward no higher goal, can accomplish no greater good, than to serve that cause, heart and soul.

The day of victory will surely come, and the words "Peace on earth, goodwill to men" will again ride the radio beams of all the world. Then America's men of science will draw upon their wartime research to develop finer and more useful products and services for peace-time purposes. Out of the ashes of war, they will bring forth implements for a new and better civilization.

DAVID SARNOFF

THE ROLE OF RESEARCH IN MODERN INDUSTRY

ON behalf of the staff of RCA Laboratories I extend to you a cordial welcome to our new home.

We are happy and proud to show you to-day the initial group of buildings which have been planned for erection here. They are the beginnings of a development which will make this place the center for the creative and forward-looking activities of the RCA family.

By accessibility of location, spaciousness of setting, utility but dignity of architecture and efficiency of equipment, we have endeavored to provide facilities and an atmosphere here that will be especially conducive to effective original work. We intend to make this place increasingly attractive in order to induce you and others to come here frequently for research services and for contemplation of the problems and the future of the radio and electronic art and industry.

These new laboratories are a monument to past research—to achievements which have brought into instantaneous communication with each other the most remote points on land and sea and in the air. By signals, by voice and by pictures, the miracle of radio has disseminated information, education, entertainment and culture to all the peoples of the world. Such contributions have made possible the laboratories we are dedicating to-day.

But these laboratories are more than a memorial to past triumphs. They are concrete recognition that research plays an essential role in modern industry; that it is a vital force for promoting the progress of science and the useful arts. They are intended to be a further contribution to industrial advancement and to social betterment by an organization whose services to the public and whose origin and progress have been based upon scientific research and original development.

Scientific research is diligent quest into the great unknown. It is the key that unlocks the doors of nature and reveals its mysteries and secrets. It frees mankind from fetters and limitations seemingly imposed by natural forces and by environment. It extends the boundaries and horizons of human knowledge and experience.

Research is a modern equivalent of geographical exploration whereby in former times new lands and additional natural resources were discovered and made available. But to-day, when there are no more continents for geographers to discover, the research explorer is faced with no such predicament. He never exhausts his field. Each new discovery seems to make research only more endless. Vast new areas are continuously being opened for development and practical use, and there is no apparent limit to the potential resources yet to be uncovered by science.

In radio and electronics we know this. There research has progressively extended the useful portions of the radio spectrum, until its availability for future communication and other services now appears to be almost limitless. Television is only one of the many new wonders for which a place has been made by such extensions. Great new regions never before seen by man have also been made visible by the electron microscope, which is profoundly influencing further developments in many branches of science and industry. Countless other new things previously undreamed of are being made realities by radio and electronic research.

In other fields science has created new materials, such as plastics; new synthetics, such as rubber and silk; new medicines, such as the sulfanilamides; new textiles; new colors, new metals and alloys; and it has produced new achievements in aviation, in transportation and housing.

Scientific research is a great provider and producer of employment for all classes of people. It affords an outlet for exercise of the imagination and genius of scientists and inventors. Through it their special talents give their best and most useful expressions. And the industries brought into being and vitalized by it employ myriads of other workers and vast amounts of capital.

It is distinctively constructive and beneficial. It does not invade the fields or destroy the rights of others. Its conquests are won only in the realm of the previously unknown and non-existent. Truly it is an instrument of the first order of social and economic importance.

With prophetic vision and wisdom our forefathers framed measures for the encouragement of scientific research—patent laws for protecting the inventions which are its logical results. No more effective or economical method of promoting the progress of science and the useful arts has ever been devised. It has been the bulwark of our industrial and social progress. It has stimulated the translation of scien-

tific discoveries into industrial achievements. It has accelerated the movement of inventions into the humblest homes.

Without our patent system, research would languish, the streams of invention would become mere trickles, our industrial supremacy would be lost, employment would be reduced, and improvements in our standards of living would be retarded.

Let us, therefore, preserve this wholesome system unimpaired in order that we may continue to enjoy the maximum benefits of research and invention. Let us be careful in attempting to effect desirable improvements in this system and to prevent its misuse, we do not weaken or destroy it. And let us also, by every means at our command, promote and expedite the distribution of its benefits to all the people.

These laboratories are not intended to pre-empt the field of radio and electronic research. In science, as in everything else, competition is the greatest spur to healthful activity. The scientists who will man the work benches in these laboratories have been in keen but friendly competition with other scientists throughout the years. The sum of the effects of all of them has greatly accelerated scientific progress.

In the alliance of science with modern industry we need both individual inventors and organized research groups. Each has its field. The flame of some men's genius burns brightest alone. Many of our greatest inventions have been made by individual scientists, with primitive equipment and with little or no help, save the inspiration of their own unquenchable spirits.

But there are many inventions that could never be made and developed in that way. They call for systematic research and for organizations of men, of materials, of equipment, of resources. The workers in these modern and effieient laboratories will have at their command all these essential factors. They will also have a valuable association with the communications, broadcasting and manufacturing services of the Radio Corporation of America. These services will be sources of ideas for development as well as of problems for solution. They will also be proving grounds for testing inventions and new devices in actual service and production. And the inventions that crystalize here will also be available under licenses to the whole radio and electronic industry.

I want to pay respectful tribute to the directors of the Radio Corporation of America for their vision, courage and broadmindedness in authorizing the building of this institution as a means of broadening and strengthening the foundations of the Corporation and of the radio and electronic industry.

Earnestly and constantly the workers in these laboratories will endeavor to render services and to produce results which will justify the confidence in them, and in the efficacy of scientific research, which is demonstrated by this wise investment for the future.

To-day, RCA Laboratories and its magnificent enrolment of men, buildings and equipment stands enlisted in the cause of war. When we leave here today, the gates will be closed to others than war workers. These structures will then be as much a part of the nation's armament as are its arsenals and forts. The men who work here will be as much members of its armed forces as if they were in the trenches on the battlefields. The work they will do will be military secrets carefully guarded against leakage or intrusion.

But I can give you this prophecy: the scientific progress made here will play a most important part on all the battlefields—on land and sea, under the sea and in the skies. When the war ends, and the ban of secrecy is lifted, the recital of accomplishments will thrill all of us and fill us with justifiable pride.

But when the war ends—when the victory is won—these men and these laboratories will stand dedicated in advance to serve the cause of a victorious peace. For therein lies the distinctive characteristic of our scientific endeavor. Its destructive power is one of the greatest weapons of war, and its constructive power is one of the greatest assets of peace. The same radio and electronic discoveries which these laboratories will have forged into weapons to tear down the ramparts of our enemies will also serve to rebuild the structures of our peace.

Because men work to-day in laboratories like these, new cities will rise from the ruins of the silent battlefields, richer crops will be harvested from the black stubble of scorched earth, and finer homes—richer at least in material things—will replace the homes that have been devastated by war.

The triumphs of science warrant our saying—amid all the horrors of war—there is still hope for civilization.

To help make that hope come true is the purpose to which these new laboratories are dedicated.

OTTO S. SCHAIRER

OBITUARY

FERNAND HOLWECK

1889–1941

THE news comes from unoccupied France that Dr. Fernand Holweck, director of research of the "Centre National de la Recherche Scientifique" and associate professor of physics at the Institute of Radium of the Sorbonne (Laboratorie Curie), was murdered by the Gestapo on December 14th, 1941, in a Paris prison. Further details are missing.

Dr. Holweck, born in 1889, graduated in physics

from the "Ecole de Chemie et Physique" of Paris, the school made illustrious by some of the greatest French physicists, among them Pierre Curie and Paul Langevin. In 1912 he became assistant to Madame Curie, and since that time all his activity was connected with the Curie Laboratory, which he helped to organize.

Holweck's thesis for the degree of science doctor was the well-known study on soft x-rays, which bridged the gap in our knowledge between the far ultraviolet region and x-rays. This study is a classic which still supplies most of the available information on the x-ray spectra of the elements of low atomic number. In the course of this research, Holweck's interest had been directed to the problem of high vacuum production: the result was the design of the Holweck molecular pump, the most powerful vacuum-producing device prior to the invention of the vapor diffusion pumps. Other of his important achievements in the field of applied physics are: the Holweck gravimetric pendulum, a tool that proved of the utmost utility in the oil survey technique; a high power radio tube which could be disassembled, and the first x-ray tube with successive stages of acceleration. Moreover, during research on television, he was among the first to develop the use of the focusing of electrons and to pioneer the developments of electron optics.

Through his lifelong friendship with Dr. A. Lacassagne, now head of the Pasteur Laboratory of the Institute of Radium, Holweck became interested in radiobiology. In 1929 he rediscovered, independently of previous work by Crowther, the quantic interpretation of the biological action of radiation on microorganisms. In the following years he made fundamental contributions in this field with studies on bacteria, fungi and viruses.

During the first World War, Dr. Holweck had substantially contributed to the application of science to defense, by studying with Langevin and Chilowsky the detection of submarines by means of ultrasonic waves. From the onset of the second World War until the defeat of France, he was actively engaged in defense work, and obtained some of the finest results achieved by French scientists in this field.

Less known than his personal achievements are Holweck's contributions to most of the research that was performed in the Curie Laboratory since its foundation. His tremendous skill as an experimenter (he was a man for whom technical difficulties just "did not exist") and his sympathetic disposition made him the willing adviser of all the scientific workers in his entourage. Many an important research was made possible by his uncanny ability to discover the way out of some technical bottleneck. Moreover, it is not an exaggeration to state that he contributed more than anybody else to the systematization of the radioactive technique, which was created in the Curie Laboratory and spread thence throughout the world.

With the exception of painting, for which he had a particular gift, Holweck's hobbies were mainly scientific. An amateur astronomer, he had built in his Paris home a complete observatory equipped with a 10-inch telescope, a source of admiration and envy of many professional astronomers. He was about to publish a study on certain peculiarities of Jupiter's satellites.

The privilege of collaborating with Holweck enabled the writers to appreciate not only his inspiring personality and deep humanity, but also the inflexible independence of his character. This independence was perhaps responsible for the fact that his ability was not always duly recognized. It is easy to imagine that such a man would refuse not only collaboration, but even obedience to the iniquitous Nazi rule in France. He has paid with his life for his love for freedom and for his country. His example will inspire all scientists of the world in their fight for the cause of liberty and democracy.

S. ROSENBLUM
S. E. LURIA

RECENT DEATHS

DR. ROSS A. GORTNER, chief of the division of biochemistry of the University of Minnesota, died on September 30. He was fifty-seven years old.

DR. WILLIAM COLEMAN STURGIS, from 1905 to 1914 dean of the School of Forestry of Colorado College, previously, from 1891 to 1901, connected with the Connecticut Agricultural Station, and for ten years educational secretary of the Board of Missions of the Episcopal Church of New York, died on September 29 in his eightieth year.

SCIENTIFIC EVENTS

EMERGENCY BASE HOSPITALS

SELECTED hospitals and medical schools in the coastal states have been invited by the Surgeon General of the U. S. Public Health Service to organize affiliated staff units which will be ready to serve when needed to supplement the medical staffs of Emergency Base Hospitals, now being designated by the Medical Division of the Office of Civilian Defense. These units resemble the affiliated hospital units of the Army except that they are smaller in size. They are being organ-

ized in order to assure suitable status and remuneration for physicians who may be called upon in the event of an enemy attack in their locality to care for casualties and other patients who have been evacuated to the interior of their region.

The designation of Emergency Base Hospitals and the formation of affiliated units are part of a joint hospital program of the Medical Division of the Office of Civilian Defense and the U. S. Public Health Service. The program is authorized under an agreement concluded on March 2, 1942, between the Federal Security Administrator and the director of the Office of Civilian Defense.

Physicians in the affiliated units will be commissioned in the inactive Reserve Corps of the Public Health Service. Unless an urgent need for their services should arise, they will remain on an inactive status for the duration of the war. They will be called to active service only if hospitals in their regions must be evacuated and the civilian populations must be moved because of military necessity. Activation of the units will take place by order of the Surgeon General at the request of the Chief Medical Officer of the Office of Civilian Defense on advice of the Regional Medical Officer and the State Chief of Emergency Medical Service in charge of the affected areas.

The commissions will be in grades ranging from Passed Assistant Surgeon to Senior Surgeon, and when units are activated, these officers will have the rank, pay and allowances equivalent to those of officers in the armed forces.

Institutions invited to form units are asked to nominate an outstanding physician or surgeon as Unit Director, who, if he meets the physical and other requirements, will be commissioned Senior Surgeon in the Public Health Service Reserve. The Unit Director will then nominate the remainder of the staff and appointments will be made after clearance through the State Chief of Emergency Medical Service. Nominations are to be limited to male physicians over 45 years of age, to those under that age who have physical disabilities which disqualify them for military service but which do not interfere with their professional activities, and to women physicians.

In order to avoid serious depletion of the professional staffs in the medical schools and hospitals of the target areas, the Surgeon General has recommended that medical schools draw their affiliated units in part from associated hospitals and that non-teaching hospitals invite physicians from other qualified hospital staffs to collaborate.

THE NATIONAL REGISTRY OF RARE CHEMICALS

THE National Registry of Rare Chemicals, Armour Research Foundation, Thirty-third, Federal and Dearborn Streets, Chicago, receives requests for sources of certain chemicals at a rate of approximately two hundred and fifty per month.

Dr. Martin H. Heeren, director of the registry, sends a list of chemicals for which no source is known to the registry. If any reader has one or more in his laboratory, he is urged to communicate with the registry. Even small amounts are important, inasmuch as all requested chemicals are to be used for experimental purposes only.

1. Diamino acetone
2. Myosin
3. Dysprosium
4. Luetecium
5. Terbium
6. Divinyl Benzene
7. Mercuric Fluoride
8. 3-Pyridine Acetic Acid
9. Glucose-l-Phosphate
10. Hexose-6-Phosphate
11. Acetyl Phosphate
12. Phosphoglyceraldehyde
13. Blood Charcoal
14. Alpha-Phosphoglycerol
15. d-3-Phosphoglyceraldehyde
16. d-3-Phosphoglyceric Acid
17. Alpha-Ketoglutaric Acid
18. Quinone Dioxime Dimethyl Ether
19. Diquinoyl Dioxime
20. Diquinoyl Tetroxime

THE OFFICE OF TECHNICAL DEVELOPMENT

A COMMITTEE of engineers and scientific men has been appointed by Chairman Donald M. Nelson to determine the manner in which the projected Office of Technical Development should be set up within the War Production Board, and to define the scope, functions and method of operations which the office should have.

Decision to establish such an office was made earlier, following a report by a previous committee recommending that the War Production Board set up a strong scientific and technical organization to make sure that the nation's technical ability and resources were utilized to the full in the war production program.

The chairman of the new committee is Webster N. Jones, director of the College of Engineering of the Carnegie Institute of Technology at Pittsburgh. Other members are:

Dr. Lawrence W. Bass, director of research, New England Industrial Research Foundation, Boston.

Dr. Oliver E. Buckley, president, Bell Telephone Laboratories, New York.

Colonel Clarence E. Davies, Ordnance Department, U. S. Army, Washington.

Dr. Ray P. Dinsmore, manager, Development Department, The Goodyear Tire and Rubber Company, Akron, Ohio.

Admiral J. A. Furer, U. S. Navy, Washington.

Dr. Jerome C. Hunsaker, head of the departments of mechanical and aeronautical engineering, Massachusetts Institute of Technology.

H. W. Graham, director of metallurgy and research, Jones and Laughlin Steel Corporation, Pittsburgh.

S. D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering,* New York.

LEAVES OF ABSENCE FOR WAR SERVICE AT THE UNIVERSITY OF MICHIGAN

DR. UDO J. WILE, professor of dermatology and syphilology and chairman of the department at the University of Michigan, has been given a year's leave of absence to enable him to accept a commission as colonel in the Army. He will serve as medical director in charge of venereal disease control in the U. S. Public Health Service.

Dr. Henry M. Kendall, assistant professor of geography, has leave for the first semester of the academic year to accept an appointment to work with the Geographic Section of the Army Intelligence.

Dr. Malcolm H. Soule, professor of bacteriology and chairman of the Hygienic Laboratory, has been on leave of absence since September. He was consultant to the director of the Division of Health and Sanitation, coordinator of Inter-American Affairs at the Pan-American Sanitary Conference in Rio de Janeiro, September 7 to 17. He will remain in South America until the end of November investigating the activities of the division in that continent.

Dr. Lowell T. Coggeshall, professor of epidemiology, has leave of absence for the months of September and October. He is in Washington organizing medical facilities for the prevention of tropical diseases.

THE DEPARTMENT OF ZOOLOGY OF COLUMBIA UNIVERSITY

CHANGES in the staff of the department of zoology of Columbia University and the appointment of an advisory committee composed of zoologists in other institutions are announced by President Nicholas Murray Butler.

Professor James H. McGregor, who has been a member of the department since 1897, becomes professor emeritus of zoology. He will continue to give his course on "The Evolution of Man" in the Department of University Extension during the winter session.

Professor H. Burr Steinbach, assistant professor of zoology since 1938, has resigned to become associate professor in the department of zoology at Washington University. Professor Arthur W. Pollister, assistant professor of zoology since 1935, has been promoted to be associate professor.

Dr. Robert Ballentine, National Research Council fellow at the Rockefeller Institute for Medical Research, has joined the department as lecturer in zoology. He will be associated with Professor Franz Schrader in instruction in elementary zoology and with Professor Pollister in the zoological part of the general science course in Columbia College.

Dr. Francis J. Ryan, National Research Council fellow at Stanford University, returns to Columbia as instructor in zoology. He will give the course in vertebrate zoology for students at Columbia College and will offer a course in invertebrate zoology for graduates and undergraduates. Mordecai Gabriel, lecturer in zoology, has been appointed university fellow.

Dr. Hans Ris, lecturer in zoology, has been appointed Seessel fellow in Yale University. Vernon Bryson has completed his work for the doctorate, and has been appointed to the research staff of the department of genetics of the Carnegie Institution of Washington, Cold Spring Harbor, L. I., N. Y. Dr. Daniel C. Pease, lecturer in zoology, has joined a war research project in the department of biology of Princeton University.

Members of the new Advisory Committee on Zoology, each of whom will serve for three years, are Professor H. B. Goodrich, Wesleyan University; Professor E. N. Harvey, Princeton University; Professor D. E. Lancefield, Queens College; Professor C. W. Metz, University of Pennsylvania; Professor H. J. Muller, Amherst College; Dr. W. Procter, Academy of Natural Sciences, Philadelphia; Professor A. S. Romer, Harvard University, and Professor L. L. Woodruff, Yale University.

The committee, it is planned, will hold annual meetings at Columbia to give the members of the Columbia department staff the benefit of their criticism and advice and to serve as a liaison between the department and the zoologists in other universities.

NATIONAL LECTURERS OF THE SOCIETY OF THE SIGMA XI

DR. GEORGE A. BAITSELL, secretary of the Society of the Sigma Xi, the national honor society for the promotion of scientific research, announces that five leading American scientific men have been named Sigma Xi national lecturers for 1943.

Chosen to address special meetings at universities and colleges throughout the nation, they will deliver their lectures during January, February, March and April of next year, and will discuss scientific subjects upon which they are authorities.

Each of the lecturers will speak in a series of insti-

tutions at dates and places to be announced later. The Sigma Xi lectures are annual events in the dissemination of the newest, important advances in the selected fields of science. The lecturers are:

Dr. G. D. Birkhoff, Perkins professor of mathematics at Harvard University, who will lecture on the "Mathematical Nature of Modern Physical Theories." He will endeavor to establish, in elementary terms, the fact that, since 1900, mathematical ideas have been responsible for theoretical advances of modern physical theories.

Dr. D. W. Bronk, professor of neurology at the University of Pennsylvania, will speak on the "Physical Structure and Biological Action of Nerve Cells." He will discuss this subject not only from the standpoint of research now in progress, but also with attention to the biological consequences of the demands of modern warfare and aviation.

Dr. Peter Debye, professor of chemistry at Cornell University, whose topic is "The Magnetic Approach to Absolute Zero," will tell what prevents science from reaching the absolute zero, and discuss whether magnetic cooling can be applied to the nucleus of the atom.

Dr. C. A. Elvehjem, professor of agricultural chemistry at the University of Wisconsin, will discuss "The Present Status of the Vitamin B Complex." He will explain that the vitamin B complex consists of at least a dozen separate factors, each of which can be obtained in pure form. He will report recent work on the use of sulfaguanidine and the evidence for the synthesis of several B vitamins in the intestinal tract.

Dr. H. Mark, professor of chemistry at the Brooklyn Polytechnic Institute. The title of his lecture is "Fundamental Aspects of the Elasticity of High Polymers." He will explain that the high polymers are chemical compounds that provide us with rubber, plastics and fibers. Dr. Mark will discuss the structure of these complex chemicals which mean so much to our war effort.

SCIENTIFIC NOTES AND NEWS

JOSIAH K. LILLY, since 1882 chairman of Eli Lilly and Company, has been awarded the twenty-first Remington Medal by the Philadelphia College of Pharmacy in recognition of his distinguished services to pharmacy. The committee of selection was composed of past presidents of the American Pharmaceutical Association. The presentation of the medal is expected to be made in the autumn at a meeting of the New York branch of the association.

MAJOR GENERAL ROBERT U. PATTERSON, U. S. Army, retired, dean of the Medical School of the University of Oklahoma at Oklahoma City, having reached the retirement age of sixty-five years, has submitted his resignation.

DR. HARRY NOBLE WRIGHT, formerly professor of mathematics at the College of the City of New York, who has for eight months served as acting president, was installed as sixth president of the college on September 30. The principal address was made by Dr. Felix Frankfurter, justice of the Supreme Court. Among other speakers were Mayor LaGuardia and Dr. Nelson P. Mead, chairman of the department of history and for three years acting president of the college.

THE Michigan College of Mining and Technology has made the following appointments to replace men who have leave of absence in order to serve with the armed forces: Professor O. Gaylord Marsh, a former consul general of the United States with service in Canada, Europe, Latin America and Korea, special lecturer in world affairs and a member of the Spanish division of the languages department; Drs. George Machwart, A. R. Kendall and Ernest Epperson, department of chemical engineering; and Jesse C. Butler, Earl Roberts and Thomas R. Richards, instructors in mathematics. Dr. Machwart has the rank of associate professor and Dr. Kendall that of assistant professor.

APPOINTMENTS of those who received in August doctorates of philosophy in agricultural and biological chemistry at the Pennsylvania State College are: James Russell Oyler, Nutrition Foundation research fellow at Columbia University; Isadore Zipkin, First Lieutenant, Sanitary Corps, U. S. Army; Laurence L. Layton, research department, Distillation Products, Inc., Rochester, N. Y.; Gertrude H. Spremulli, Ranger Aircraft Engines, Farmingdale, L. I.; Seymour S. Block, Seagram's, Lawrenceburg, Ind.

DR. I. FANKUCHEN, formerly of the University of Cambridge, England, has joined the staff of the department of chemistry of the Polytechnic Institute of Brooklyn for the coming academic year. Dr. Fankuchen, a former associate of Dr. W. L. Bragg, is known for his investigations in the field of x-ray and electron diffraction. The laboratory will be under the supervision of A. L. Davis, of the Polytechnic staff. Both the lecture and laboratory sessions will be held on Saturdays from 9 A.M. to 1 P.M., beginning on October 10.

AT Hofstra College, Dr. J. George Lutz has been made associate professor of chemistry and acting chairman of the department; Dr. E. Russell Stabler has been appointed assistant professor of mathematics, Dr. Leonard B. Brabec, assistant professor of chemistry, and H. Hunter Smith, assistant professor of physics.

SIR JOHN ORR, director of the Rowett Research

Institute, Aberdeen, has been appointed professor of agriculture in the University of Aberdeen. He will retain the directorship of the institute.

THE John and Mary R. Markle Foundation has authorized a grant-in-aid of $7,000 over a two-year period for the support of the research in experimental renal hypertension in progress at the College of Medicine of the University of Illinois. The work is under the direction of Dr. George E. Wakerlin, professor and head of the department of physiology. Dr. C. A. Johnson, assistant professor of physiological chemistry; Dr. E. L. Smith, instructor in physiology, and others are associated in the investigation.

THE following grants have been made by the Committee on Scientific Research of the American Medical Association: Frederick M. Allen, New York Medical College, Local Refrigeration in Surgery; Walter Schiller, Cook County Hospital, Chicago, Ovarian Tumors; Meyer M. Harris, Psychiatric Institute, New York, Further Research on Muscular Disease; Arthur H. Smith, Wayne University College of Medicine, Metabolism of Citric Acid; Tuberculosis Committee, Minnesota State Medical Association, J. A. Myers, *chairman,* Tuberculosis Survey of Meeker County, Minnesota.

JOHN TEE-VAN, executive secretary of the general staff of the New York Zoological Society and an associate in the department of tropical research, has been appointed acting curator of reptiles, to succeed Raymond L. Ditmars, who died on May 12. Mr. Tee-Van became associated with the society in 1911, when he was appointed assistant keeper in the department of birds.

G. DALLAS HANNA, curator of the department of paleontology of the California Academy of Sciences, San Francisco, has been appointed in addition administrative assistant to the director.

DR. STANLEY J. SEEGER, Texarkana, Texas, chairman of the Council on Industrial Health of the American Medical Association, according to the *Journal* of the association, has been named consultant to the Division of Industrial Hygiene of the National Institute of Health.

DR. FERDINAND W. HAASIS, senior clerk, U. S. Army Quartermaster Corps, Camp Roberts, Calif., has been appointed to senior scientific aide in the Special Guayule Research Project of the U. S. Bureau of Plant Industry, Salinas, Calif.

CAPTAIN CHARLES W. O. BUNKER, commander of the Naval Medical School, Bethesda, Md., has been assigned to command the Naval Medical Center at Bethesda and has been nominated for promotion to rear admiral. He succeeds Rear Admiral Charles M. Oman, who will become commanding officer of the Naval Convalescent Hospital, Harriman, N. Y. Captain Paul W. Wilson has been named to succeed Captain Bunker as head of the School of Medicine.

DR. FRANKLIN G. EBAUGH, professor of psychiatry of the School of Medicine of the University of Colorado and medical director of the Psychopathic Hospital, has leave of absence for the duration of the war. With the rank of lieutenant colonel he will serve as chief psychiatric consultant with the Eighth Service Command. His headquarters are at Fort Sam Houston, San Antonio.

CHARLES F. BONILLA, of the department of chemical engineering of the Johns Hopkins University, who has been appointed a member of the Board of Economic Warfare, has left for an eight weeks' trip to Brazil.

DR. MAYNARD A. JOSLYN, assistant professor of fruit technology at the University of California, who has been commissioned a captain in the U. S. Army, has been selected to aid in the development of a food dehydration industry overseas. He is one of two men who will be placed in charge of the development of the industry. The other, who will be a Canadian, has not yet been selected.

W. G. HOWARD, of the Department of Forests, Albany, has been appointed state area coordinator for New York State for the new Forest Fire Fighters Service of the Office of Civilian Defense.

DR. GEORGE BAEHR, chief medical officer of the Office of Civilian Defense, has gone to England to study Britain's Emergency Medical Service and to confer with medical leaders. Dr. Baehr will remain abroad for several weeks.

DR. E. C. STAKMAN, chief of the division of plant pathology and botany of the University of Minnesota and agent for the U. S. Department of Agriculture, will deliver an illustrated lecture on "Genetic Variation in Plant Pathogens and Its Practical Importance" on Friday evening, October 23, at a joint meeting at the Palmer House of the Institute of Medicine of Chicago and the Chicago Society of Internal Medicine.

THE program of Laity Lectures for the coming session at the New York Academy of Medicine is as follows: November 12, "Food and Civilization," Dr. R. R. Williams; December 10, "War and Medicine," Colonel Edgar Erskine Hume; January 28, open; February 25, "Aggressiveness—Individual and Collective," Dr. Franz Alexander; March 25, "Growing up Normally," Dr. Myrtle McGraw; April 22, "Crime and Punishment," Dr. Bernard Glueck.

THE Association of American Geographers will

hold its 1942 annual meeting at Columbus, Ohio, on December 28, 29 and 30, with sessions conducted at the Ohio State University. The program will be devoted primarily to facts and problems related to the war and to the post-war period of reconstruction. A joint session with Section E of the American Association for the Advancement of Science in New York has also been planned. The geographical contributions to this joint session will present a series of papers dealing with Latin America.

THE fifty-sixth annual meeting of the Association of Land-Grant Colleges and Universities will be held in Chicago at the Drake Hotel on October 28, 29 and 30. Preliminary meetings will be held as required during the period from October 24 to 27. The meeting this year is encouraged and its importance emphasized by the recent statement of the Science Committee "that the present emergency calls for the greatest mobilization of scientists, scholars and educators in the history of the United States, and it is clear that the societies and associations into which they are organized have an important part in the war effort. This part includes not only direct participation by scientists, technologists, scholars and others in war activities, but also the discussion of present and future problems and the maintenance of a vigorous intellectual life."

THE annual meeting of the American Science Teachers Association will be held at the Hotel Pennsylvania, New York City, on Tuesday and Wednesday, December 29 and 30.

DR. A. V. KIDDER, president of the American Anthropological Society, has made the following announcement: "In view of the fact that scientific organizations whose activities are not directly concerned with the war effort have been requested by the coordinator of transportation not to hold meetings, the executive committee of the American Anthropological Association has voted to postpone until after the war the scheduled annual meeting in Toronto. As, however, the constitution of the association requires that a meeting be held annually for the presentation of reports, the election of officers and the passage of the budget, it has been decided to hold a meeting for business purposes only at the Cosmos Club in Washington at 8:30 on the evening of December 29. Washington has been selected for this purpose because the necessary quorum of twenty members can be obtained with a minimum of travel."

THE new Mineral Industries Building of West Virginia University at Morgantown will be dedicated on October 16.

THE American Gastroenterological Association on January 1, 1943, will publish the first issue of a new journal to be called *Gastroenterology*. It will be owned by the association and will be its official publication. It will appear monthly and will be published by the Williams and Wilkins Company. Dr. W. C. Alvarez has been made editor (after June, 1943) and Dr. A. C. Ivy, assistant editor, with the following editorial board: Drs. A. H. Aaron, Buffalo; J. A. Bargen, Rochester; H. L. Bockus, Philadelphia; W. C. Boeck, Los Angeles; B. B. Crohn, New York; R. Elman, St. Louis; F. Hollander, New York; Sara Jordan, Boston; J. L. Kantor, New York; B. R. Kirklin, Rochester; P. Klemperer, New York; F. H. Lahey, Boston; F. C. Mann, Rochester; H. J. Moersch, Rochester; V. C. Myers, Cleveland; W. L. Palmer, Chicago; J. M. Ruffin, Durham; R. Schindler, Chicago; and D. L. Wilbur, San Francisco. The journal will print clinical and investigative contributions which are of interest to the general practitioner as well as to the specialist dealing with the diseases of digestion and nutrition, including their physiological, biochemical, pathological, parasitological, radiological and surgical aspects. Manuscripts should be sent to Dr. A. C. Ivy, *Gastroenterology,* 303 East Chicago Avenue, Chicago.

THE fourth ten-year Index of the Electrochemical Society, covering the years 1932 to 1941, inclusive, is now in press. Every subject discussed in the transactions of the society during the past ten years has been indexed and cross-indexed. This book of two hundred pages is a convenient source of accurate and up-to-date information covering every topic of interest in electrothermics, electrodeposition, electronics, theoretical electrochemistry and allied fields.

AN electron microscope has recently been purchased by the University of Missouri from the RCA Manufacturing Company and is now being installed in a centrally located laboratory where it may be used by all investigators who have use for such an instrument, as those in the departments of soils, zoology, botany, chemistry, physics and geology.

ACCORDING to the *Times,* London, the University of Durham has received an offer from the Nuffield Provincial Hospitals Trust to provide a grant of £15,000 towards the cost of establishing a chair of child health at King's College, Newcastle-on-Tyne. The senate and court of the university have accepted the proposal. They have appointed Dr. J. C. Spence as professor, and the council of King's College has expressed its intention to provide him with the assistance necessary for creating a full teaching and research department. The Royal Victoria Infirmary and the Babies' Hospital, Newcastle, will cooperate with King's College by providing all possible facilities for the new department, which will be concerned with the preservation and restoration of the health of children. The department will provide undergraduate

and post-graduate teaching in child health and the diseases of childhood, will be a center of research and will be at the disposal of local public health and education authorities of the region for advice and consultation in the conduct of their child welfare and school medical services.

DISCUSSION

CHROMOSOME NUMBERS IN MAMMALS AND MAN

HAVING had occasion recently to survey the chromosome numbers in Marsupials and placental mammals, a group in which many new and accurate counts have been made in recent years, it seems worth while pointing out some of the relationships which emerge. In Marsupials the most common diploid number is 22, although certain genera have 12 or 14. On the other hand, the armadillo (Edentata) has 60, which is also the usual number in Ungulates so far as known, the horse, cattle, yak, goat and sheep all having this number. In domestic pigs and in peccaries the known numbers are respectively 38 and 30. In Carnivora the numbers range from 34 in the fox to 78 in the dog. This suggests the possibility that in dogs doubling has taken place through crossing under domestication. In Rodentia the numbers are variable, 40 and 42 being frequent numbers in mice and rats, while the squirrels appear to range from 28 to 62, and even higher numbers have been counted in certain genera of rodents. The single species of bats whose chromosome number has been determined has 48. This number is found in all the Primates hitherto studied, that is the Rhesus monkey, chimpanzee and man, with the exception of a brown Cebus monkey having 54.

Although many counts remain to be made, certain tendencies are already clear. The placental mammals have numbers which are generally more than double those found in the marsupials, the ungulates having generally higher numbers than the primates. The evolutionary tendency has clearly been to an increase in chromosome numbers. In plants such increases in numbers have frequently been through allo- or autopolyploidy, and this can be confirmed by a study of the nucleoli.[1] It is still uncertain in how far the number of nucleoli in animals can be used as an index of the number of sets of chromosomes.

It was formerly assumed that polyploidy in animals would upset the sex chromosome mechanism, although I predicted[1a] that, in dioecious plants such as Salix, chromosome doubling would be followed by a process of readjustment of the sex chromosomes, so that the sex balance would be maintained. The more careful papers on mammal cytology have all described an unequal XY pair, or rarely an XO condition which, however, can hardly be regarded as certainly authenticated in any case. In dioecious plants, where the conditions are essentially similar to those in most animals, it turns out that doubling of the chromosomes does not necessarily have the effect predicted. For example, tetraploid forms of *Melandrium album*, produced by heat treatment, had in the male $2n = 44 + XXYY$ and in the female $2n = 44 + XXXX$.[2] When these 4n males and females were crossed together, the plants (with $44 + XXXY$) were not intersexes but pure males, apparently owing to a strong dominant factor for maleness in the Y-chromosome. Even $4n \times 2n$ gave triploid males and females with $2n = 33 + XXX$ (♀), and $2n = 33 + XXY$ (♂), respectively. Blakeslee[3] independently showed that in dioecious Melandrium when the chromosomes are doubled the species ultimately settles down to a balanced tetraploid condition with equal numbers of male (XXXY) and female (XXXX) individuals. Similarly, tetraploidy was induced in *Carica papaya* by the use of colchicine.[4] Of the 4n plants so obtained, 9 were ♀, 4 ♂, 1 ☿. As might be expected, the sex balance differs from one species to another.

Chromosome doubling in the higher mammals is therefore by no means ruled out, and it is possible that the 48 chromosomes of the primates and man may be a secondary tetraploid number. This might help to explain the relatively frequent occurrence of intersex conditions in man. Various critical studies of the sex chromosomes in man, *e.g.*, by Painter (1923) and Koller (1937),[5] indicate that the X and Y bear satellites and therefore probably produce the nucleoli. A study of the nucleoli in human spermatogenesis should furnish evidence on the possible presence of more than one pair of nucleoli, but as the number 48 is evidently an ancient one, it is probable that in man (as in some varieties of rice) the mutational loss of a pair of nucleolus-producing loci will have occurred long since, leaving only one pair.

That chromosome evolution is going on in man is indicated by the fact (Koller, 1937) that a man descended in the second generation from a cross between a Scotswoman and a Frenchman was heterozygous for an inversion in a chromosome segment. The study of meiosis in racial hybrids may therefore disclose chro-

[1] See Gates, *Bot. Review*, 8: 337–409, 1942.

[1a] Polyploidy and sex chromosomes. *Nature*, 117: 234. 1926.

[2] M. Westergaard, *Dansk. Bot. Arkiv.*, 10: 1–131, 1940.

[3] Effect of induced polyploidy in plants, *Amer. Nat.*, 75: 117–135. 1941.

[4] J. D. J. Hofmeyr and H. van Elden, *S. Afr. Jour. of Sci.*, 38: 181–185, 1942.

[5] T. S. Painter, *Jour. Exp. Zool.*, 37: 291–336, 1923; P. C. Koller, *Proc. Roy. Soc. Edinb.*, 57: 194–214, 1937.

matin rearrangements, and possibly also (as in Drosophila) the order of their occurrence, as an aid in the study of racial relationships.

If mammals, like plants, retain for long periods their extra nucleoli arising through polyploidy or any other form of duplication of the nucleolus-producing chromosomes, then the nucleoli should prove a valuable aid in tracing phylogenies in this group of animals. It is now well known that in insects polyploidy in the fat bodies and other organs is a general feature of the ontogeny. From the work of Jacobi, Wermel and others, in which the nuclei of the liver and other organs fall into a geometric series of volumes, it is evident that something of a similar kind, perhaps polyteny, may take place in human ontogeny. Polyploidy in animals may thus prove to be much more wide-spread than we have been accustomed to suppose.

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LONGEVITY OF FOWL SPERMATOZOA IN FROZEN CONDITION[1]

PRESERVATION of life in monocellular organisms by storage at low temperatures offers many possibilities in biological studies requiring long-time storage. As cited by Luyet,[2] Brehme reported that cholera vibriones survived continuous freezing for 57 days at −1° C to −16° C and Prucha and Brannan, also cited by Luyet, isolated *Bacillus typhorus* from ice cream kept for 20 months at −20° C. Jahnel[3] reports that some human spermatozoa resumed motility after having been held at −79° C for 40 days and Shettles[4] reports the resumption of motility of human sperm after 70 days' storage at −79° C.

A technique for preserving chicken spermatozoa by storage at low temperatures has been described by Shaffner, Henderson and Card.[5] Results from experiments using slight modifications of the original technique indicate that time is not an important factor in the retention of motility within the first year, when fowl semen is held constantly at the temperature of solid CO_2. Spermatozoa have been maintained at a temperature of dry ice (−79° C) for 14 months. Little if any difference could be noted in the percentage of cells that regained motility between samples thawed immediately after freezing or those thawed after 14 months storage.

Unmated hens producing infertile eggs were inseminated with semen that had been frozen at −79° C and thawed an hour later. Of 48 eggs produced by these hens after insemination 12 were fertile. However, in no case did the resulting embryonic development proceed for more than 10 to 15 hours, as determined macroscopically.

C. S. SHAFFNER

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[1] Journal paper No. 20, Purdue University Agricultural Experiment Station.
[2] B. J. Luyet, Life and Death at Low Temperature, *Biodynamico*, Normandy, Missouri, 1941.
[3] F. Jahnel, *Klin. Wchnschr.*, 17: 1273, 1938.
[4] L. B. Shettles, *Am. Jour. Physiology*, 128: 408, 1940.
[5] C. S. Shaffner, E. W. Henderson and C. G. Card, *Poultry Science*, 20: 259, 1941.

THE ERADICATION OF NUT GRASS

FOUR years ago E. V. Smith and E. L. Mayton[1] reported that they were able to control nut grass by "plowing or disking at intervals of three weeks or less during two consecutive growing seasons." As the writer's[2] laboratory experiments have shown that nut grass is killed by 1 N chlorate or 2 N thiocyanate solutions, it seemed worth while to see if the chemical method would not offer a cheaper and quicker way of control of nut grass than that suggested by Smith and Mayton.

The experiments were performed during the spring and summer of 1940 on plots which contained 250–500 plants of nut grass per square meter. One liter of solution was applied per square meter. The chlorate ion was applied in the form of sodium chlorate, the thiocyanate ion in form of calcium thiocyanate. The author is very much obliged to the American Cyanamide and Chemical Corporation, New York, for the supply of the calcium salt. The results compiled in Table I show clearly that the result of the field experiments were less satisfactory than those of the laboratory experiments. One fifth to one fourth of the plants were still surviving after 20 days. Though some of them were very weak and died within 10 more days, still about one tenth of the weeds survived and were able to repopulate the field. Also a repeated application of the herbicide would not kill them.

TABLE I

Substance	Normality	No. of experiments	Percentage of plants surviving at 20th day	Percentage of plants surviving at 30th day
ClO_3^-	2	3	26	12
CNS^-	2	2	15	10
CNS^-	1.5	2	15	..
CNS^-	0.7	2	40	22

The reason for this incomplete control was the same as for the failure of simple tillage as a method of eradication of nut grass: the bulbs, which are the most resistant part of the plant, are relatively deep below the surface and can not all be reached by the weed killer if its solution is applied to the surface only. In May and July, 1940, further experiments in neighboring plots were, therefore, conducted in this

[1] *Jour. Am. Soc. Agron.*, 30: 18, 1938.
[2] *Rev. agr., ind. y com.*, Puerto Rico, 33: 180, 1941.

way: The field was first turned over to a depth of 5 to 6 inches and then treated with the solution of the herbicide. When 2 N chlorate solution was applied this way at a rate of one liter per square meter, only 16 plants (*i.e.*, 4 per cent. of the control) were seen per square meter after 20 days. In analogous experiments with one liter of 2 N thiocyanate per square meter the number of plants was reduced to 1 per cent. or less of the control within 90 days, so that the eradication was virtually complete. Two to three months after these experiments the plots have been used again for the cultivation of corn, tomatoes and cayenne pepper without any damage to the crops. In the two following years of cultivation no new infestation with nut grass has been observed in these fields.

Hence, the simultaneous application of tillage and a 2 N thiocyanate solution seems an equally effective and cheaper way of controlling nut grass than the frequent plowing, as recommended by Smith and Mayton.

F. FROMM

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THE DUTY OF THE ENTOMOLOGIST[1]

IT has been customary in France to designate certain scientific societies, organized without reference to commercial profit, as societies of public utility. Now, in the midst of war, we have to ask, Is the work of entomologist of public utility, and if so, in what respects? To-day I received from the Royal Entomological Society of London a large package of highly technical papers, just published, with many excellent illustrations. It would, I am afraid, have proved difficult to get those papers published in the United States, or if they were, the authors would have been expected to pay for the figures. For some time, Professor Ferris of Stanford University has been bringing out a fully illustrated treatment of the scale insects or Coccidae. Although this group of insects has great economic importance, Ferris had to put up a large sum of money to get the last part published and he states that he can not continue the work on that basis. It appears probable that we shall be deprived of a work which would be of very great value, not only now, but in the years to come.

In wartime the standard of values changes. The ordinary scientific worker, such as the present writer, has been accustomed to carry on researches looking toward a more or less remote monograph, which we may never live to see. We have regarded our work much as a mother regards her child: always interesting, very dear to us, always growing, and we hope, destined to mature and do things in the course of years. But in wartime we need results to-morrow, something which can be applied without delay to the existing situation. It is not altogether easy to adjust our minds to the new conditions, but we must do it. Just now I am much interested in the appointment, by both army and navy, of numerous entomologists who will accompany the various units to different parts of the world, and will have to ascertain the presence of any insects or other arthropods which may convey disease organisms to the troops. I am sure they will save many lives and reduce the incidence of malaria in particular. When things have become more stabilized, it is proposed that the entomologists who have to stay at home shall nevertheless have an important service to give, that of supplying information and getting species identified. Already it is possible to give some advice of consequence. Thus in New Caledonia they have neither *Anopheles* nor malaria. In the New Hebrides, not far away, they have both. Under war conditions it might be possible to accidentally carry *Anopheles* to New Caledonia, and the results might be disastrous. There are various other similar cases.

Now it will be noticed that the rapid work of the war-time entomologist is only possible because of the patient labors of earlier workers, extending through many years. This work would be more efficient if more such work had been done, but since it was clearly recognized that insects were connected with disease, the amount of study given to such insects is tremendous, and is published in many splendid memoirs. So, also, the insects affecting the crops have been intensively studied, though not yet sufficiently.

One thus comes to the conclusion that although we must largely concentrate on matters which are of immediate urgency, the relatively slow march of science should not be halted. It is quite right to urge, as a war policy, that we should reduce the use of luxuries, but it does not seem right to classify scientific work under this head. The research work of entomologists, in any country, involves only a small number of workers, and the publication facilities which they need are, as compared with other types of publication, exceedingly small. There should, indeed, be a stepping-up of research, with increased rather than diminished facilities. This not only for economic reasons, but as promoting a sane outlook on life.

T. D. A. COCKERELL

UNIVERSITY OF COLORADO

[1] In 1927, my wife and I were in central Siberia, working under the auspices of the Geological Committee of the U.S.S.R. At that time there were, I believe, about 200 trained geologists exploring all parts of the vast Russian dominions, mapping the country and recording the deposits of coal, iron and various minerals. If I had suggested at that time that the work of these geologists would, fifteen years later, be of vital importance to the United States, the idea would have seemed too fantastic to be worth discussing.

SCIENTIFIC BOOKS

TEXT-BOOKS ON COLLOIDAL CHEMISTRY

A WRITER, recently commemorating the centenary of a famous volume, remarked that no science rises above its text-books. I sincerely hope that this is not true, but if it is true, then we are under strict obligation to see to it that our text-books maintain a high standard. In many ways, this is a difficult if not impossible task, but, through cooperative work, it is at least possible to prevent the repetition from text-book to text-book of errors to which critics have repeatedly called attention. I am told that in past years some text-books in zoology carried the obviously erroneous statement that the erythrocyte of the camel was the only known nucleated mammalian red blood cell. The error persisted for thirty-five years until some one had the ingenious idea of going to the zoo, getting some camel's blood and looking at it. Of course, he found that the cells, like all other mammalian red blood cells, were without nuclei.

It is about thirty-five years since Wolfgang Ostwald presented his "emulsoid" classification of colloids, and it is nearly twenty-five years since Hatschek stated that the emulsoid nature of jellies is untenable. It is now more than a dozen years since I called attention to the confusion which the term emulsoid has caused, and pleaded for its rejection.

A new biological text has just come into my hands. The author states that "protoplasm is an emulsion or, technically, an emulsoid," and that it may exist as a sol or gel. Aside from the fact that protoplasm is only superficially an emulsion, and the fact that the recognized technical name of an emulsion is not emulsoid, there is the further fact that a pure emulsion can not form a gel.

If the author of a biological text turns to a book on physical chemistry he may find the matter accurately presented, as it is in Getman and Daniels, but very briefly so and without a colloidal flavor. There will probably be no mention of jellies. If he turns to a volume on colloidal chemistry or biochemistry he may or may not find the matter correctly put. Thus, the lone statement that "emulsoid usually emphasizes a combination of the phases" is but feebly true and misleading.

Gortner enumerates the customary eight classes of colloids, and under liquid-in-liquid systems discusses gelation and the properties of lyophilic colloids in general. He there makes no mention whatever of the true liquid-in-liquid systems, the emulsions, but later under a separate heading takes them up. To call gelatin a liquid-in-liquid system is enough to coagulate the blood of any living member of that noble assemblage of colloid chemists which includes such familiar names as Donnan, Ellis, Hatschek, Freundlich, Proctor and Wilson, and to these I feel confident that I can add Staudinger, Sheppard, Kraemer and Williams.

Liquid-in-liquid systems are emulsions, and if they must be below the limit of microscopic vision they can be made so. It was Donnan and Ellis who pointed out that pure colloidal emulsions are model *suspension* colloids, and therefore of the same class as solid-in-liquid systems, such as colloidal gold. Gelatin is but feebly related to the suspensions, so little so that Duclaux in 1925 excluded the solid and liquid suspensions from his book on "Les Colloids," which shows that all along some workers have understood and some have not.

Classifying gelatin as a liquid-in-liquid system is the kind of reasoning which leads to confused situations such as the attempt to distinguish between emulsions, emulsoids and jellies, by defining emulsoids as stabilized emulsions. This is probably an effort to explain why emulsions such as milk and latex coagulate. The misunderstanding is a common one and is due to the fact that natural emulsions are not pure systems. Milk is certainly an emulsion, but it just as certainly contains casein, and when milk curdles it is the casein that does so, the emulsion or butter-fat having nothing whatever to do with it.

The same situation arises in connection with protoplasm. It is impossible to characterize protoplasm as this or that kind of system except by some such all-inclusive term as polydispersoid, which tells very little except that protoplasm is exceedingly heterogeneous.

I have never been a strong advocate of precise terms and final definitions. A name too often takes the place of an idea, frequently to obscure an erroneous idea. Yet, a language consists of words and only through them can we express our thoughts.

Relatively little attention has been given to colloidal nomenclature. Rheologists have made a thorough study of the terms of their science, and the anatomists and taxonomists hold conventions for this sole purpose. It is twenty-five years since Thomas wrote that the use of the term gel "is deplorably loose and confusing." I doubt if its use is any more specific to-day.

In many instances the loose use of an expression is not serious. Thus, "colloidal solution," deplored by some, is much used by others. Zsigmondy thought it not inaccurate. It at least does little harm because of the adjective colloidal. Quite other, however, is it with that *bête noir,* the word "emulsoid." In order that this troublesome term may once and for all be thrown out, and also that other erroneous or misleading words and ideas may be eliminated or corrected, I suggest that the Colloid Chemical Division of the American Chemical Society and the Colloid Commit-

tee of the National Research Council officially adopt an at least tentative nomenclature.

Not only terms and definitions should be given consideration but some antiquated text-book ideas as well. One which I should like to have dealt with is the following. Several years ago I was an "expert witness" in a legal trial having to do with the harmful effects of sulfuric acid "fumes," or mist, set free in a commercial plant. The opposition pointed out that there could be no fumes because of the very low vapor pressure of sulfuric acid, to which all agreed, but I held it was mist, and not fumes, with which we had to deal. The opposition, still preferring to condense fumes which were not there rather than disperse the liquid acid by spattering, insisted on the presence of dust in order to produce mist, but owing to wet floor and walls no dust could be present. Their contention that dust must be present was based on the old text-book statement that atmospheric vapor is condensed on dust particles, forming colloidal droplets which, suspended, constitute mist. Though the discussion seemed to me irrelevant, for acid was being dispersed and not fumes condensed, I nevertheless answered the question on the need of dust particles in the negative, and was adjudged in error. The "expert witness" of the opposition was not a colloidal chemist, so, of necessity, had accepted what he had read in colloidal text-books.

Texts are so often assumed to be a collection of facts, when, actually, they are a collection of opinions. That mist results from the condensation of atmospheric moisture on the surface of dust particles is an opinion that I have always doubted. It persists as a text-book hypothesis, a relic of the early days of colloidal chemistry. There is no reason why the aggregation of atmospheric moisture should necessarily take place only under special conditions requiring nuclei, when so many other forms of colloidal and molecular aggregation take place without nuclei. Nuclei are not necessary for the precipitation of solutions, the formation of colloidal suspensions from matter in solution, the production of gels by coagulation of colloidal dispersions and the agglutination of living cells in suspension.

As in the case of salts crystallized out of solution, nuclei may hasten the process, but they are not necessary. Bancroft states that dust is not necessary for the production of mist, though nuclei cause the formation of mist at lesser supersaturations than would ordinarily be necessary.

We move on rapidly to an understanding of profound and far-reaching problems and leave many simpler questions just where they were in the early days of our science.

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SOCIETIES AND MEETINGS

THE JUNE SPECTROSCOPY CONFERENCE AT THE UNIVERSITY OF CHICAGO

FROM June 22 to 25 a conference was held at the University of Chicago, consisting in a series of symposia on various pure science aspects of spectroscopy. The program and the participants ranged over the fields of chemistry, physics and astronomy. Papers were presented by thirty invited speakers at eleven sessions, including some discussion papers prepared in advance. The estimated total attendance was between 250 and 300. The papers and discussion are being published as the April–July number of *Reviews of Modern Physics*.

After an introduction by the writer describing the background and purposes of the conference, the first morning session, on Monday, June 22, consisted in a symposium by physicists on "Spectroscopic Methods." Henry G. Gale, of the University of Chicago, who had agreed to act as chairman at this session, was prevented from doing so by a recent operation. W. F. Meggers, of the Bureau of Standards, W. E. Williams, of University College, London (now in Pasadena), and H. G. Beutler, of Chicago, were the chief speakers in discussions on standard wave-lengths and the concave grating. The use of the isotope 198 of mercury, obtained by transmutation of gold, as the source of a new primary standard of wave-length was proposed. The afternoon session was a symposium by astronomers and astrophysicists on "The Spectra of Comets." The speakers were N. T. Bobrovnikoff, Perkins Observatory; G. Van Biesbroek, Yerkes Observatory; A. McKellar, Dominion Astrophysical Observatory, and P. Swings, Yerkes Observatory. In addition, a paper was communicated by G. Herzberg, professor of physics at the University of Saskatchewan, in which for the first time a polyatomic molecule, the CH_2 radical, was identified as giving rise to cometary spectra. This was particularly interesting in that the spectrum of this important radical had not hitherto been known. Since the conference, Dr. Herzberg has reproduced the cometary CH_2 spectrum in a laboratory discharge tube. At the Monday evening session, four physicists who have worked in the field took part in a very satisfying symposium on "Atomic Beam Spectra." They were K. W. Meissner, Purdue; R. A. Fisher, Northwestern; J. E. Mack, Wisconsin, and W. E. Williams, Pasadena.

The Tuesday morning program on "The Earth's

Atmosphere and the Constitution of the Planets" was made up of papers by F. L. Whipple, Harvard Observatory; C. T. Elvey, McDonald Observatory, and R. Wildt, Princeton, with O. R. Wulf, Chicago, as chairman. The afternoon session on "Atomic and Molecular Spectra" returned to the physicists with papers by W. F. Meggers, J. E. Mack and G. Herzberg. Dr. Meggers showed how the very complicated spectra of the rare earth metals are at last being unravelled. The conference dinner on Tuesday evening was followed by brief talks by A. H. Compton, O. Struve, K. K. Darrow, J. Franck and W. F. Meggers. Professor Struve spoke on "Astronomy Faces the War."

On Wednesday and Thursday the program dealt mainly with the spectra of increasingly complicated molecules, with chemists and physicists taking part. The Wednesday morning symposium, with four physicists participating, was on "Triatomic Spectra." The speakers, E. F. Barker, Michigan, R. S. Mulliken, Chicago, S. Mrozowski, Chicago, and H. H. Nielsen, Ohio State, discussed both infrared and ultraviolet spectra. In the afternoon, physical chemists and a physicist took part. The speakers were W. H. Rodebush, Illinois; Miss H. Sponer, Duke; A. L. Sklar, Catholic University, and A. Turkevich, Columbia, with K. F. Herzfeld, of Catholic University, as chairman. The discussion referred largely to ultraviolet spectra of benzene and its derivatives. Professor Rodebush mentioned that the absorption spectrum of rubber changes on stretching. At the evening session on "Spectra of Dye Molecules," after an introduction by W. G. Brown, Chicago, L. G. S. Brooker, Eastman Kodak Research Laboratory, organic chemist, presented empirical generalizations based on a wealth of examples, and A. L. Sklar, presenting work by himself and K. F. Herzfeld, showed that these can be explained remarkably satisfactorily by quantum mechanics.

On Thursday morning, Miss E. P. Carr and Miss L. W. Pickett, of Mount Holyoke, described their extensive work on diene spectra (including butadiene); R. S. Mulliken and Mrs. C. A. Rieke discussed some quantum-theoretical studies on benzene and other molecules, and Mrs. M. Goeppert-Mayer, Columbia, reported the results of quantum-mechanical computations on the Wurster salts; G. W. Wheland, Chicago, was chairman. The Thursday afternoon and evening sessions were on "Cooperative Spectra," with J. Franck and P. Pringsheim, of Chicago, as chairmen. S. E. Sheppard, Eastman Kodak Research Laboratory, presented much interesting material about dye spectra. E. Rabinowitch, Massachusetts Institute of Technology, and S. Freed, Chicago, discussed the spectra and structure of ion complexes. P. Pringsheim, Chicago, described experiments on absorption and phosphorescence of potassium-thallium-halide phosphors, carried out in Belgium and Berkeley. G. N. Lewis, who had expected to give a paper, was prevented from coming by last-minute developments.

In the introduction on the first day, the writer described the background and purposes of the conference, then expressed the belief that the maintenance of at least a minimum of fundamental research activity even in those fields of pure science having no obvious connection with the war effort, is wise national policy. This talk, with some omissions and changes, was as follows:

Viewed broadly, spectroscopy is a very large subject, with ramifications in many directions in physics, astronomy, chemistry and biology. The data of modern astrophysics, for example, are obtained very largely through the use of the spectroscope.

In recent years, a number of very successful conferences have been held which have been devoted primarily to the practically very important field of the application of spectroscopy in spectrochemical analysis. Less attention has been given lately to spectroscopy as pure science.

It therefore seemed to us that the time was ripe for a conference on spectroscopy to present the broad picture of spectroscopy as pure science.[1] We also thought it would be desirable to further better acquaintance and a stronger consciousness of underlying unity among those using spectroscopy in different fields of pure science. We therefore planned a conference to consist of a number of symposia, each in a special field connected with or based on spectroscopy, and so arranged as to cover each day a considerable range of subjects. In this way, we hoped that visitors would find some familiar things and also other less familiar things to interest them and to bring them into contact with others in different fields. For instance, the astrophysicists might exchange ideas with the pure spectroscopists or with those interested in the structure of atoms or molecules; the ultraviolet spectroscopists with the infrared spectroscopists; or the chemical physicists with the organic chemists interested in spectra.

Last winter we were for a time in doubt as to whether to go ahead with our plans. There were two questions. With so many scientists going into war activities, it might have been that too few could find the time to come. The second question was that of the relative importance of pure science in wartime as compared with science applied directly to winning the war.

[1] The committee on the conference consisted of O. Struve (astronomy); J. Franck and W. G. Brown (chemistry) and R. S. Mulliken (physics).

As far as speakers were concerned, we soon found that most of those whom we approached were able and willing to come. This to a large extent answered the first question. It also helped in answering the second. The fact that a large proportion of the speakers were engaged in war work, some very extensively, indicated that they agreed with us as to the importance of maintaining the development of pure science where possible.

I think we are all convinced that pure science research is a matter of very great long-run value to the nation. Granting this, there are two reasons why it is important now to keep it going. In the first place, we do not know how long the war will last; there is enough of a probability that it will last for a long time, so that weight should be given to activities of long-run importance even for their possible value in winning the war. In the second place, weight also should clearly be given to pure science so that the nation's scientific foundations will be strong when peace finally comes.

There are some fields of pure science which are so fortunate as to have had their development greatly accelerated as a direct part of the war program. Here the path is clear. In other fields, however, which are no less important for the progress of science in the long run, the effect is reversed. Although, in general, priority must be given to the fields of direct short-term value, nevertheless I am convinced that workers in the long-term fields should feel that they too are making a valuable contribution to the national effort by carrying on their work as effectively as possible.

Quoting a letter received this spring from a British colleague, "I am so sure that above all we must see that some fundamental research tradition is preserved at our universities. There is a danger here in Britain of it stopping, through sheer pressure of work. I hope that it won't stop with you in America. In the last war we lost about 15 years in our British universities through it; we must not let that happen again."

ROBERT S. MULLIKEN

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SPECIAL ARTICLES

GROWTH OF CANCER TISSUE IN THE YOLK SAC OF THE CHICK EMBRYO

BY the simple process of injecting a suspension of tumor cells directly into the yolk, we have succeeded in growing cancer tissue in the yolk sac of the developing chick embryo. Tumors up to 3.5 grams in size have been produced in this manner with an initial inoculation of .05 gram of tumor tissue.

It has been known for some time that cancer tissue can be grown on the chorio-allantoic membrane of the developing chick embryo.[1] This technique, however, has proved to be somewhat limited in its scope, since it involves removing a piece of the egg shell and the depositing of the tumor tissue directly on the chick membranes. This effects considerable interference with the embryo and the mortality rate among eggs so treated is about 65 per cent., according to Stevenson.[2] Further, the initial inoculation must be small (.003 to .005 grams), and large tumors can not be produced regularly because they are likely to interfere with the growth and development of the chick.

In the present method each egg can be inoculated in a few seconds, the mortality rate is little more than that of untreated eggs, and 100 per cent. takes can be expected.

Mammary carcinoma transplants of the DBA and C_3H strains of mice were used. Moderate size tumors (1 to 2 grams in weight) were dissected out aseptically and squeezed through muslin cloth so as to disperse the cancer tissue. This material was diluted with saline solution to the extent where each ml of suspension contained about .2 gram of tumor tissue. Tumors which had external lesions and were infected could not be used as donors. It is well known that tumor transplants in mice may grow in an apparently normal manner even when some bacterial infection is present. Such tumor material naturally could not be used for injection into the egg yolk. The presence of necrotic tissue in the injected material also resulted in the death of the embryo.

Fertile eggs after incubation for 4 or 5 days at 38° C. were used for inoculation. A needle-sized opening was made in the shell area over the air sac and .25 ml of the tumor suspension was injected hypodermatically into the yolk, using a 20-gauge needle 1¼ inches in length. The opening in the shell was then sealed over with cellulose tape. It has been our experience that the egg can accommodate a much heavier inoculation of tumor tissue.

After inoculation, the eggs were incubated at 37° C. for 12 or 13 days or until the total incubation time was 17 days. The injected tumor tissue became attached to the inner wall of the yolk sac from which it obtained its blood supply. The bulk of the tumor, which tended to conform in appearance with the mouse-grown variety, grew down into the yolk of the yolk sac cavity. In this position there was plenty of room for growth without mechanical interference with the embryo mem-

[1] J. B. Murphy, *Jour. Am. Med. Asn.*, 59: 874, 1912.
[2] H. N. Stevenson, *Jour. Cancer Research*, 3: 63, 1917.

branes. Tumors grown in this manner grew readily when transplanted back into mice. As long as care was taken to obtain clean tissue free of yolk and other extraneous materials the takes and growths in the mouse appeared unchanged from its original behavior in these respects.

It appeared, however, that cancer cells were also diffused through the yolk substance, since subdermal injection into a mouse of untreated yolk from cancer-inoculated eggs was sufficient to produce a tumor of the same type as the donor tissue for the egg.

Histological sections revealed healthy-appearing cancer cells with numerous mitoses in progress. The supporting stroma was supplied by the yolk sac membrane.

For many problems in cancer research this new method of growing cancer tissue should be of value. The tumors so produced are contained in a relatively stable biological system which at the same time is open to some manipulation.[3] Further, since the stroma is furnished by the chick tissue, different types of tumors can be studied against a common background.

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THE EFFECT OF 11-DESOXY-17-HYDROXY-CORTICOSTERONE ON RENAL EXCRETION OF ELECTROLYTES[1]

IN an earlier report[2] data were presented which indicated that adrenal steroid compounds possessing a hydroxyl group on C_{17} in the presence of an oxygen atom on C_{11} stimulated the renal excretion of sodium and chloride in normal dogs in contrast to the well-known "sodium and chloride-retaining" effect of 11-desoxycorticosterone, corticosterone and dehydrocorticosterone. At that time it was not possible to determine the physiological effect of the addition of the hydroxyl group on C_{17} in the absence of an oxygen atom on C_{11} because of inability to obtain crystalline 11-desoxy-17-hydroxycorticosterone (Substance "S", Reichstein). Recently Professor T. Reichstein, of Basel, succeeded in providing us with a sample of this compound which, when tested in a normal dog, indicated that it belonged to the group of compounds possessing "sodium and chloride-retaining" property (Table 1). The addition of a hydroxyl group on C_{17}, however, definitely reduced the "sodium and chloride-retaining" potency of desoxycorticosterone.

TABLE 1

EFFECT OF THE INJECTION OF 25 MG OF 11-DESOXY-17-HYDROXYCORTICOSTERONE. (SUBSTANCE "S," REICHSTEIN)

24-hour period	Urine volume	Sodium	Chloride	Potassium	Inorganic phosphorus	Total nitrogen	Body weight
	cc.	*m.eq.*	*m.eq.*	*m.eq.*	*mg*	*gm*	*kg*
Control .	490	63	54	20	570	10.3	12.8
Treated .	390	34	38	14	480	10.1	12.9
Control .	470	55	50	16	520	11.1	12.9
Control .	420	58	54	18	450	10.6	12.8

It is of interest to note that whereas the addition of a hydroxyl group on C_{17} to a compound which possessed a very striking "sodium and chloride-retain-

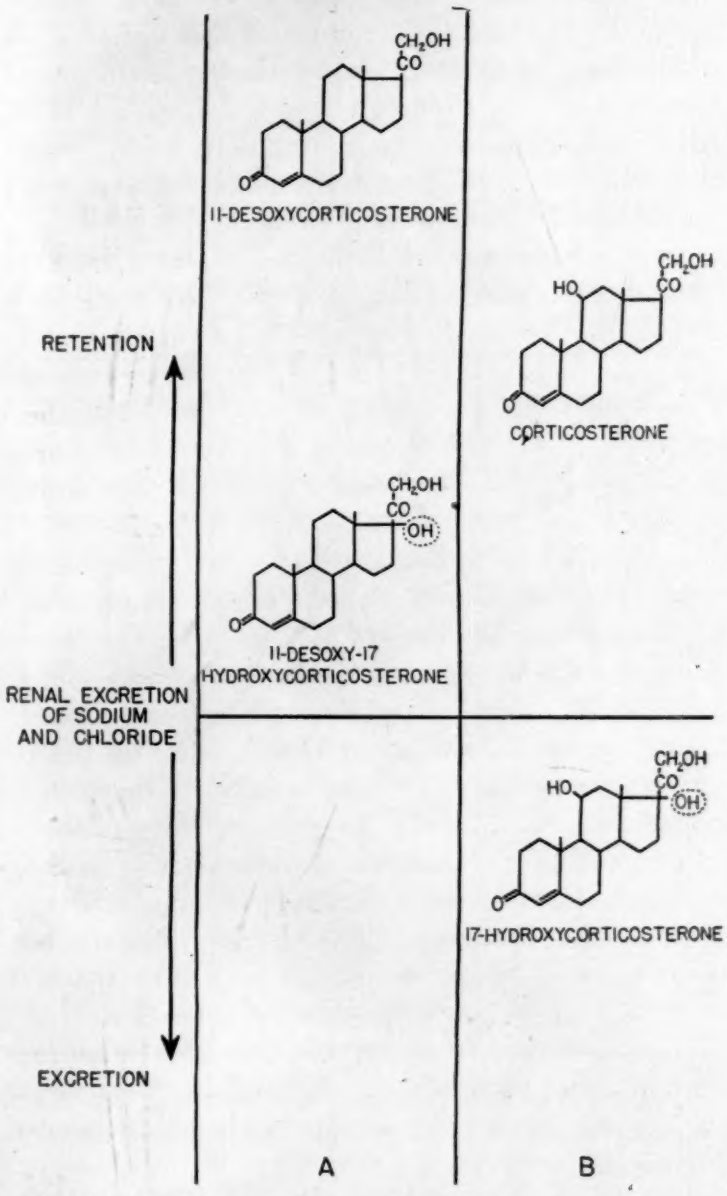

FIG. 1. Adrenal steroids: The relation of changes in chemical structure to the renal excretion of sodium and chloride. Compounds in column "A" do not possess carbohydrate-regulating-activity whereas compounds in column "B" do.

[3] A. Taylor, J. Thacker and D. Pennington, SCIENCE, 94: 542, 1941.

[1] This study was aided by a grant from the Committee on Research in Endocrinology, National Research Council.

[2] G. W. Thorn, L. L. Engel and R. A. Lewis, SCIENCE, 94: 348, 1941.

ing" property, *i.e.*, desoxycorticosterone, resulted in the formation of a compound with relatively low "sodium and chloride-retaining" potency, the addition of a hydroxyl group on C_{17} to a compound which initially possessed moderate "sodium and chloride-retaining" potency, *i.e.*, corticosterone, resulted in the formation of a compound in which all "sodium and chloride-retaining" effect had disappeared. In this latter instance, the new compound actually facilitated sodium and chloride excretion (Fig. 1).

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CHILDREN'S SPEECH

IN a recent note about my studies (SCIENCE, December 26, 1941) John B. Carroll stated that he had tried without success to study mathematically the distribution of words in children's speech. The readers of SCIENCE may therefore be interested in the nature of the results of a fairly extensive mathematical investigation that I have been conducting on this subject.[1]

In Fig. 1 is presented the Rank-Frequency distribution of the different ranked words (X) with their respective frequencies (Y), with straight lines connecting successive points, of an aggregate of approximately 24,000 words dictated into an Ediphone by a girl during the six weeks preceding her fifth birthday, as reported by R. S. Uhrbrock.[2]

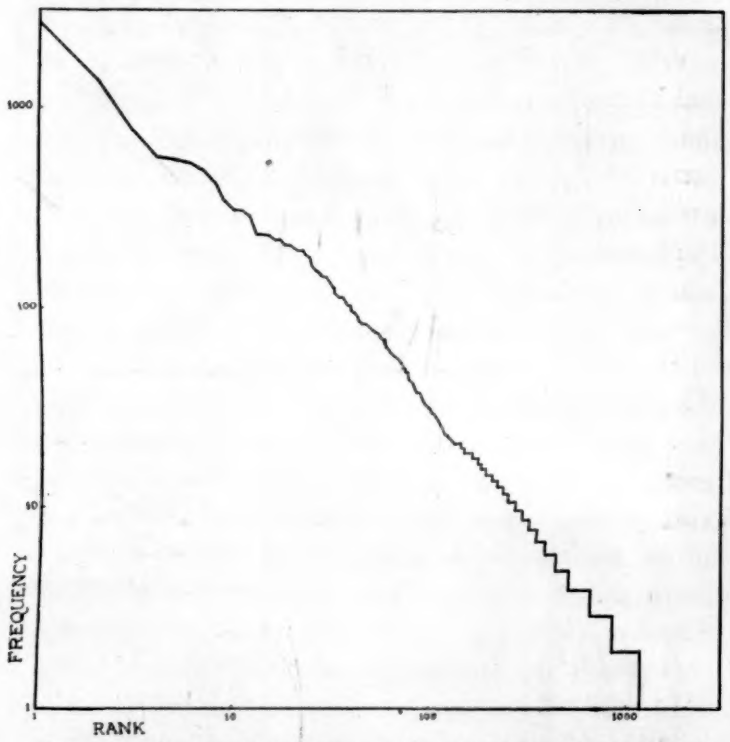

FIG. 1. The rank-frequency distribution of *ca.* 24,000 running words of a five-year-old girl recorded by R. S. Uhrbrock.

Dr. Uhrbrock put at my disposal the manuscript not only of the above material, but also of the dictations of the same girl made on or about her 6th, 6½th and 7th birthdays. The results of five samples of 2,000 words each from the 5-, 6½- and 7-year material, and of two samples of the same length from the less extensive 6-year material are presented in Table I, where the closeness of the calculated values to the theoretical slope, −1, is apparent. The best lines of X's and of Y's were calculated by least squares, and the error is the root-mean-square error of the deviations from the best line of Y's.

TABLE I

RANK-FREQUENCY DISTRIBUTION OF THE UHRBROCK RECORDINGS OF THE SPEECH OF A GIRL

Sample number	Age	Length of sample (words)	No. ranks (X)	Best X-slope (negative)	Best Y-slope (negative)	Error (Y)
5	yrs.	1 2,002	513	.97	.92	.086
		2 2,000	501	.95	.93	.055
		3 2,003	496	.96	.92	.077
		4 2,000	484	.97	.94	.078
		5 2,000	475	1.00	.95	.091
6	yrs.	1 2,000	466	1.00	.96	.080
		2 2,000	459	.99	.96	.081
6½	yrs.	1 2,000	467	.99	.95	.082
		2 2,000	500	.97	.93	.077
		3 2,000	413	1.02	.99	.074
		4 2,000	404	1.02	.99	.074
		5 2,000	476	.96	.93	.069
7	yrs.	1 2,000	437	1.02	.99	.074
		2 2,000	440	1.01	.98	.074
		3 2,000	398	1.04	1.01	.076
		4 2,000	457	.98	.95	.070
		5 2,000	487	.95	.92	.073

In addition to the above Uhrbrock material I have similarly analyzed the words of the extensive speech-material ranging from 22 through 59 months as collected and reported by M. S. Fisher[3] and as generously made available to me for the above purposes by Dr. L. H. Meek, director of the Child Development Institute of Teachers College, Columbia University. Though the 72 samples examined vary considerably in size and in best Y-slope, nevertheless the median slope is −1.02. In discussing the above material in greater detail in a future publication,[4] I shall present quantitative information on the general relationship between the size of sample and slope[5] and also the positive correlation

[3] John D. Archbold fellow in medicine.

[1] This investigation was made possible by grants from the Milton fund and from the Committee on Research in the Social Sciences at Harvard University. I here acknowledge the help of my wife and of my research assistants, Miss Inez Randall and Dr. Sydney Fairbanks.

[2] R. S. Uhrbrock, *Ed. Research Bull.*, 14: 85–97; also *Jour. Ed. Psychol.*, 27: 155–158.

[3] M. S. Fisher, *Child Development Monograph* No. 15, New York, 1934.

[4] Chap. III of "The Principle of Least Effort" now in preparation.

[5] G. K. Zipf, "The Psycho-Biology of Language," p. 44, Boston, 1935; *Jour. Psychol.*, 4: 239–244; *Psychol. Record*, 2: 347–367.

between age of child and size of the constant, C (in terms of R F = C), together with an analysis of its possible bearing upon the problem of intelligence and of the general meaning of bends from the straight line.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

HYPO-PROTHROMBINEMIA PRODUCED BY 3,3'-METHYLENEBIS (4-HYDROXYCOUMARIN) AND ITS USE IN THE TREATMENT OF THROMBOSIS

PROTHROMBIN is formed in the liver, and it can be assumed that one or more enzymes are responsible for its formation. The activity of the enzymes is dependent on the presence of vitamin K, which may possibly be a prosthetic group attached to an active protein. On this assumption, the administration of a compound that could displace vitamin K and thus inactivate the enzymes would produce a hypo-prothrombinemia and thus could be used to reduce the incidence of post-operative thrombosis and thrombosis from other causes. Several naphthoquinone derivatives were tried first but without success.

The work of Quick,[1] Schoefield[2] and Campbell *et al.*[3] showed that the ingestion of spoiled sweet clover (*melilotus albus*) by cattle and rabbits caused a hypoprothrombinemia. The active agent was isolated by Stahmann *et al.*[4] and shown to be 3,3,[1]-methylenebis (4-hydroxycoumarin). This compound, called AP (antiprothrombin), was supplied by the Ferrosan Company of Malmö, Sweden, and used in the following experiments.

When AP is given per os to rabbits in a dose of 3–4 mg/kg the prothrombin index (Quick) was lowered for 1–2 days to between 10–20. (Similar effects have recently been reported by Overman *et al.*[5]). This effect was reproducible and reversible. Fig. 1 shows that the prothrombin index rapidly returns to normal even after almost daily administration of the drug for a month. No toxic effects were seen on the circulation, respiration, intestines, liver, kidney, heart and the composition of the blood. The lethal dose is 250 mg/kg for rabbits, almost ten times the effective dose. The cause of death was not determined but is probably the result of kidney damage. Fig. 2 shows that the simultaneous administration of 5 mg of vitamin K has no effect on the action of AP. Blood transfusion can raise the prothrombin level for 3–5 hours in the animal receiving the drug.

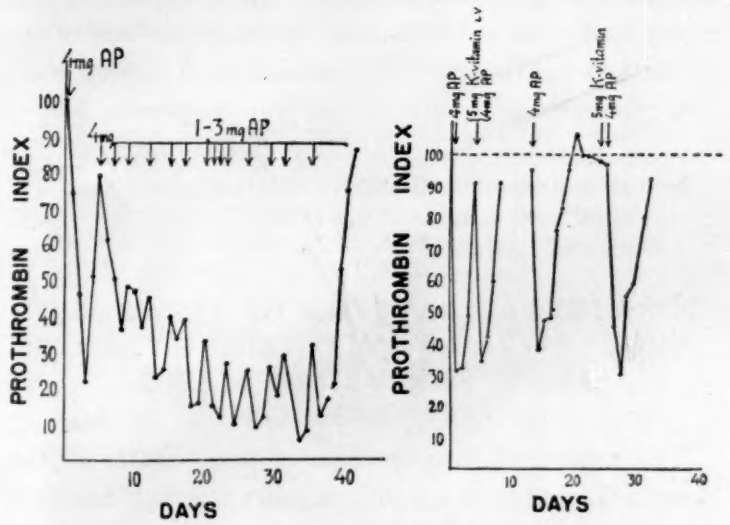

FIG. 1. The restoration of the normal prothrombin index in the rabbit after administration of AP for one month. FIG. 2. The inability of 5.0 mg of vitamin K to antagonize the effect of AP on the prothrombin index of the rabbit.

When 0.25–1.0 gm of AP is given by mouth to normal human subjects a similar fall of the prothrombin index occurs. Seventeen cases of thrombosis of the extremities were treated. When the initial fall in prothrombin index occurred there was a concomitant improvement as indicated by the fall in temperature, and diminished turgor of the leg. Cases of thrombosis cruris (*phlegmasia alba dolens*) were more resistant to the drug and required larger doses. In all cases the course of the disease was shortened and no further thrombosis occurred after the fall in the prothrombin index. Administration of AP is contraindicated in kidney, heart and liver diseases. In actual or suspected vitamin C deficiency, ascorbic acid should be given along with the drug to prevent hemorrhages. The use of AP in the prevention of post-operative thrombosis is under investigation.

In man mild toxic symptoms, such as vomiting and diarrhea, were observed in a few cases after the first administration of the drug, but seldom after subsequent ones. Liver and kidney function tests after treatment with the drug were normal. In two cases minor hemorrhages occurred. These were controlled by the administration of 100–200 mg of 2-methyl-1,4-naphthaquinone disulfate which increased the pro-

[1] A. J. Quick, *Am. Jour. Physiol.*, 118: 260, 1937.
[2] F. S. Schoefield, *Canadian Vet. Rec.*, 3: 74, 1922; *Jour. Am. Vet. Med. Asn.*, 64: 553, 1924.
[3] H. A. Campbell, W. K. Smith, W. L. Roberts and K. P. Link, *Jour. Biol. Chem.*, 136: 47, 1940; 1938: 1, 1941.
[4] M. A. Stahmann, C. F. Huebner and K. P. Link, *Jour. Biol. Chem.*, 138: 513, 1941.
[5] R. S. Overman, M. A. Stahmann, W. R. Sullivan, C. F. Huebner, H. A. Campbell and K. P. Link, *Jour. Biol. Chem.*, 142: 941, 1942.

thrombin index within 3–12 hours. In 4 cases menstruation occurred while AP was being administered and the prothrombin index was 20, but no excessive bleeding was noted. Two pregnant women in the 5th and 9th months, respectively, were successfully treated for thrombophlebitis. Lactating women excrete AP in their milk, as indicated by the lowering of the prothrombin level in the children. The drug can be administered with sulfathiazole, barbiturates and morphine and can be given to patients with tuberculosis and pneumonia.

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THE MINERAL PATTERN OF STEMS FROM VEGETATIVE AND FLOWERING PLANTS AS DETERMINED BY MICRO-INCINERATION[1]

THE ashing of thin sections of plant material was described more than a hundred years ago.[2] Since then investigations of this type have been conducted with both plant and animal tissues. However, considerable difficulty has been encountered when dealing with plant sections, since there is a marked tendency for the thick cell walls to shrink and become displaced during incineration.

Previous investigations have shown that the anatomical structure of a flowering stem is different from that of a vegetative stem.[3, 4] Sections of the fourth internode of stems of vegetative and flowering plants were incinerated to observe the mineral pattern in these two types of stems. When observing minerals on a microscopical scale it is necessary to retain as much of the mineral substance after incineration as was present in the living plant. Therefore attention was given to the selection of a fixative which would not dissolve the mineral substance and which would not add mineral substances to the ash. Little or no difference in the amount or distribution of the ash could be detected in the samples fixed in four liquids: absolute alcohol, nine parts of absolute alcohol and one part of formalin, cellosolve and dioxan. Dioxan, however, seemed to have a shrinking effect upon the stem material. The alcohol-formalin mixture was used for further sampling. The material for sectioning was dehydrated in absolute alcohol and cleared in cedarwood oil. After embedding in paraffin, transverse and longitudinal sections 15 μ in thickness were cut on a rotary microtome.

Several substances were tested for their adhesive qualities in an attempt to prevent shrinkage and displacement of the heavy walled cells of the secondary tissue during the incineration process. These adhesives were applied after the paraffin was removed from the sections with xylol. Of the several tried, "Nevillite 123,"[5] which is practically ash free, proved to be the most satisfactory when dissolved one part to two to four parts of xylol depending upon the hardness of the tissue. Photographing of the sections before and after ashing disclosed no change in the position of the crystalline inclusions and wall-impregnating substances during incineration. With this adhesive a more accurate mineral pattern of the thick-walled plant tissue may now be secured.

The amount and pattern of the ash in the vegetative and flowering stems was found to be different. In the plants examined, such as *Cosmos,* poinsettia, *Xanthium* and Wealthy apple, the greater ash residue was present in the flowering stem, particularly in the thick-walled tissues of the vascular cylinder and the outer layers of the cortex.

Samples were also taken of the internodes beginning at the second from the stem-tip through the twelfth inclusive to observe the mineral pattern at different levels of the stem. The greatest difference in the amount of ash in vegetative and flowering stems was in the internodes closer to the stem-tip. Beyond the seventh internode the quantity of ash, although still less in the vegetative stem, was not as different from that of the flowering stem as it was in the higher internodes.

Plants of *Salvia, Cosmos* and *Xanthium* were placed in short days, an environment in which flower primordia are initiated. There was more ash in the stems of plants in the short-day treatment than in those remaining vegetative in long days after 8, 7 and 6 days, respectively.

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[1] Published with the permission of the director of the Agricultural Experiment Station.

[2] F. V. Raspial, Paris. Bailliére, 1833.

[3] O. Christine Wilton and R. H. Roberts, *Bot. Gaz.*, 98: 45–64, 1936.

[4] B. Esther Struckmeyer, *Bot. Gaz.*, 103: 182–191, 1941.

[5] Secured from the Neville Company, Neville Island, Pittsburgh, Pa.

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